

## Florida Manatee (*Trichechus manatus latirostris*)

The Florida manatee is a subspecies of the West Indian manatee that occurs only in the southeastern United States, occupying the northern limit of the species' range. Under the Endangered Species Act, West Indian manatees are listed as endangered throughout their range, which extends along the Atlantic coast of the Americas from the southeastern United States to northern Brazil. Like all manatees, Florida manatees are herbivores that inhabit coastal waters and rivers and feed on aquatic plants, particularly sea grasses.

Although Florida manatees have ranged as far north as Rhode Island in summer, they are unable to survive long periods in waters below about 18°C (65°F). Thus, in winter they are confined almost exclusively to the lower two-thirds of the Florida peninsula. Before the 1950s the availability of warm water likely restricted their winter range even more. Historical information on their winter distribution and abundance is limited, but it seems likely that manatees were largely restricted to the Everglades in southern Florida, where areas of warm water within the manatee's thermal tolerance occur year-round, and perhaps a few small areas north of the Everglades (e.g. natural springs or deep holes that retain heat), such as those used by manatees today.

Since the 1950s warm-water outfalls from power plants on both coasts of Florida have effectively extended the manatee's winter range to coastal areas north of the Everglades. Those outfalls actually may have improved the ability of manatees to survive cold winter periods by providing more reliable warm-water refuges. A large majority of Florida manatees now retreat to artificial warm-water sources during prolonged winter periods of cold weather that lower water temperatures. As water temperatures rise in the spring, manatees disperse throughout Florida, with some animals regularly moving north along the Atlantic coast to Georgia and South Carolina and others west along the Gulf of Mexico coast to Louisiana.

Reliable estimates of the total number of Florida manatees are not available because turbid coastal water and rivers make them difficult to count during aerial surveys. However, winter surveys carried out during cold periods, when a majority of animals congregate at warm-water refuges, have established a minimum population size. The highest manatee count was made during a January 2001 survey when 3,276 animals were seen. Roughly half that number occur on Florida's Atlantic coast and half on its Gulf of Mexico coast, with almost no movement from one coast to the other. Because winter counts can vary by 50 percent or more, and it is not known how many animals are away from refuges or not seen when counts are made, it has not been possible to use these survey data to estimate total abundance. Nevertheless, increasing counts from other databases since the late 1970s strongly suggest that the population has increased by some uncertain amount. However, recent trends for some areas, principally southwestern Florida, are unknown.

The greatest threats to Florida manatees are human-caused deaths, principally collisions with watercraft, and the loss or alteration of habitat. To evaluate the causes of death, the Florida Marine Research Institute of the Florida Fish and Wildlife Conservation Commission retrieves and examines all reported manatee carcasses whenever possible. As shown in Table 8, approximately one-third of all known manatee deaths are due to human causes. Over the past five years, at least 28 percent have been caused by watercraft. In 2002 watercraft-related deaths reached a record high of 98, of which 95 were in Florida. This is the third new record in the last five years.

Manatee deaths due to watercraft have increased steadily since the 1980s, and the rate of increase has exceeded the rate of increase for total mortality, indicating that the problem is becoming worse. According to analyses cited by the Fish and Wildlife Service, between 1976 and 2001 watercraft-related deaths increased annually at a rate of 7.3 percent compared with an annual increase of about 6 percent for total manatee mortality. In the last 10 years the average annual increase in watercraft-related manatee deaths has risen about 10 percent per year compared with about 7.5 percent per year for total mortality. Thus, the proportion of total mortality due to watercraft is increasing.

Manatees also are subject to periodic die-offs due to exposure to brevetoxins produced by red tides. As noted in Chapter VI, at least 33 manatees are thought to have died during a red tide event in the spring of 2002 in southwestern Florida.

The loss of essential habitat, particularly sea grass beds on which manatees feed and warm-water refuges, also poses major threats to Florida manatees. Over the past 50 years coastal development has significantly altered Florida's coastal ecosystems. Increased turbidity and other forms of pollution have eliminated most of Florida's sea grass beds (although regrowth has occurred in some areas) and reduced the number of natural, quiet secluded areas used by manatees to rest, give birth, and nurse their young in safety.

As for warm-water power plants, those built before the 1980s are permitted to discharge heated cooling water directly into coastal waters. Such discharges are prohibited at plants built since 1980. Most of those older plants, however, are reaching the end of their planned operational lives and, unless they are repowered (i.e., their existing electric generating units are replaced with new, more efficient equipment), they could be shut down in the near future. If outfalls from those plants are eliminated and not replaced, many manatees that have learned to use them may be unable to find alternative refuges and die. Those that do find other refuges may find that development and habitat alteration have limited food resources in those areas, making them unable to support a large influx of displaced animals. Even natural warm-water springs face an uncertain future. Increased pumping of groundwater for domestic, agricultural, and industrial uses has lowered watertables and caused significant reductions at some major natural warm-water refuges. If this trend continues, springs now used by manatees may not discharge enough warm water for animals to survive winter periods.

The Fish and Wildlife Service and the Florida Fish and Wildlife Conservation Commission share lead responsibility for developing and carrying out manatee recovery activities. In the 1980s and early 1990s, with support from the Florida Legislature, directives by the Florida Governor and Cabinet, and a well-conceived manatee recovery plan, cooperation between the two agencies and other concerned parties produced a well-directed conservation strategy. Among other things, that strategy featured a research program focused on manage-

ment-related information needs, the development of a broad network of boat speed regulatory zones and a few small no-entry areas at warm-water refuges, and initiatives to guide the construction of new boating facilities in key manatee habitats (e.g., through the review of related permit applications and the incorporation of facility siting plans into county manatee protection plans).

Over the past five years, the willingness of involved parties to work cooperatively to resolve issues has dissolved into a bitter discord marked by litigation and polarized views regarding further conservation needs. On the one hand, some parties, noting that minimum abundance estimates for manatees have nearly tripled since the early 1980s, have resisted any new efforts to establish boat

**Table 8. Known manatee mortality in the southeastern United States (excluding Puerto Rico) reported through the manatee salvage and necropsy program, 1978–2002**

Year	Vessel-Related Deaths No. (%)	Flood Gate and Lock Deaths No. (%)	Other Human-Related Deaths <sup>1</sup> No. (%)	Perinatal Deaths No. (%)	Other Deaths <sup>2</sup> No. (%)	Total Deaths in the Southeastern United States
1978	21 (25)	9 (11)	1 (1)	10 (12)	43 (51)	84
1979	24 (31)	8 (10)	9 (12)	9 (12)	28 (36)	78
1980	16 (25)	8 (12)	2 (3)	13 (20)	26 (40)	65
1981	24 (21)	2 (2)	4 (3)	13 (11)	74 (63)	117
1982	20 (17)	3 (3)	2 (2)	14 (12)	78 (67) <sup>3</sup>	117
1983	15 (19)	7 (9)	5 (6)	18 (22)	36 (44)	81
1984	34 (26)	3 (2)	1 (1)	26 (20)	66 (51)	130
1985	35 (28)	3 (2)	3 (2)	23 (19)	59 (48)	123
1986	33 (26)	3 (2)	1 (1)	27 (22)	61 (49)	125
1987	39 (33)	5 (4)	4 (3)	30 (26)	39 (33)	117
1988	43 (32)	7 (5)	4 (3)	30 (22)	50 (37)	134
1989	51 (29)	3 (2)	5 (3)	39 (22)	78 (44)	176
1990	49 (23)	3 (1)	4 (2)	45 (21)	113 (53)	214
1991	53 (30)	9 (5)	6 (3)	53 (30)	54 (30)	175
1992	38 (23)	5 (3)	6 (4)	48 (29)	70 (42)	167
1993	35 (24)	5 (3)	7 (5)	39 (27)	61 (41)	147
1994	51 (26)	16 (8)	5 (3)	46 (24)	76 (39)	194
1995	43 (21)	8 (4)	5 (2)	56 (28)	91 (45)	203
1996	60 (14)	10 (2)	1 (0)	61 (15)	284 (68) <sup>4</sup>	416
1997	55 (22)	8 (3)	9 (4)	61 (25)	113 (46)	246
1998	67 (28)	9 (4)	7 (3)	52 (21)	108 (44)	243
1999	83 (30)	15 (5)	8 (3)	52 (19)	116 (42)	274
2000	79 (28)	7 (3)	9 (3)	58 (21)	126 (45)	279
2001	82 (24)	1 (0)	7 (2)	63 (19)	183 (45)	336
2002 <sup>5</sup>	98 (31)	5 (2)	9 (3)	53 (17)	150 (48)	315

<sup>1</sup> Includes deaths due to entanglement and ingestion of marine debris, drowning in shrimp nets, poaching, vandalism, etc.

<sup>2</sup> Includes deaths due to cold stress, other natural causes, and undetermined causes.

<sup>3</sup> Includes 38 deaths attributed to a spring redtide event in southwestern Florida.

<sup>4</sup> Includes 149 deaths attributed to a spring redtide event in southwestern Florida.

<sup>5</sup> Data for 2002 are preliminary.

Source: Florida Fish and Wildlife Conservation Commission.

speed zones or constrain the construction of new watercraft facilities. They maintain that population recovery seems to be progressing under existing measures and the population appears to be large enough to sustain current mortality levels. On the other hand, some parties note that expanded efforts to count manatees may have accounted for much of the increase in minimum abundance estimates, that the number of boating facilities and boats in important manatee habitat areas continues to multiply, that management measures have to date demonstrated little effectiveness in limiting increases in watercraft-related manatee deaths, and that a long-range strategy to prevent the loss of essential manatee habitats, such as warm-water refuges and sea grasses, has not been developed. In the face of Florida's still burgeoning human population, many worry about the long-term safeguards for coastal habitat and species.

The Governor of Florida brought concerned parties together to resolve disparate views at a "manatee summit" on 19 October 2000. The Fish and Wildlife Service revived an inactive manatee recovery team to help update the Florida Manatee Recovery Plan, and this was approved in 2001. However, neither effort was directed at establishing an ongoing process for working through differences.

The Marine Mammal Commission attempted to help resolve outstanding issues by conducting a detailed review of the manatee recovery program at its annual meeting in October 2000 in St. Petersburg, Florida. As discussed in previous annual reports, Commission recommendations resulting from that meeting were provided to the involved agencies. Among other things, it recommended that the Fish and Wildlife Service—

- increase funding to establish an enforcement task force to target boat speed zones of particular concern around the state on a periodic basis,
- proceed with rulemaking to designate new manatee refuges to help control boating activity in key areas and protect warm-water refuges, with a goal of expanding the system of such areas over the long term,
- work with the state and the Army Corps of Engineers to develop criteria for distinguishing between boating facilities that would and would not jeopardize manatees, and
- convene regular meetings of the recovery team to help identify and implement recovery activities.

The Commission also recommended that, as part of state efforts to accelerate the completion of county manatee protection plans, the Florida Fish and Wildlife Conservation Commission work with other federal and state agencies to develop specific criteria on how to protect manatees and manatee habitat for use in preparing and evaluating county manatee protection plans. It also strongly endorsed a proposal to add 100 new officers to the Florida Division of Law Enforcement to help improve enforcement of new boat speed zones. Most of these recommendations were either not adopted or only partially adopted.

In 2002 little was done by the lead agencies to bring parties together, and views of the concerned parties became increasingly polarized during the year. Lawsuits and threats of additional lawsuits dominated the attention of involved agencies and parties. Actions undertaken in 2002 are discussed below.

## Watercraft-Related Manatee Deaths

Manatee deaths due to watercraft are the principal cause of human-related mortality and are increasing at a faster rate than total known mortality, suggesting that the problem is becoming worse. Almost all of these deaths are caused either by wounds from propellers or by blunt trauma impacts from fast-moving boats (Fig. 34). To address the problem, managers have relied principally on establishing a broad network of boat speed zones in 13 key counties where manatees occur. Because boaters cannot reliably detect and avoid manatees, managers sought to slow boats down in those parts of waterways where manatees are most likely to occur to provide time for manatees to avoid oncoming boats.

Over the past 12 years, speed zones have been established throughout waterways in those 13 counties as well as other parts of the state. Most of the zones have been developed and implemented by the Florida Fish and Wildlife Conservation Commission and its predecessors in consultation with county officials and local interest groups. Establishment of these zones has relied on negotiations to balance the needs of both manatees and boaters through use of various types of seasonal and year-round speed zones. These include channel-exempt, channel-inclusive, and shoreline speed zones with various speed limits (e.g., idle or slow speeds outside channels but 25 mph in marked

channels), high-speed water sports areas, and, in a few limited cases at warm-water refuges, small no-access areas. Both the Florida Fish and Wildlife Conservation Commission and the Fish and Wildlife Service increased efforts in this regard in 2002 (see below). Other management tools that have been brought to bear include enforcement of those



Figure 34. Collisions between watercraft and manatees are one of the major causes of Florida manatee deaths, and the vast majority of living manatees bear multiple scars from nonlethal collisions. (Photo by Robert K. Bonde, courtesy of the Sirenia Project, Center for Aquatic Resource Studies, U.S. Geological Survey.)

zones, limiting or conditioning permits for the construction of new boat access facilities (e.g., marinas, boat ramps, and docks) in key manatee habitat, and public education and outreach.

In 2002 Fish and Wildlife Service enforcement officers organized 12 two- or three-day enforcement operations to improve compliance with manatee-related speed zones in Brevard, Collier, Lee, Sarasota, and Volusia Counties. The initiatives targeted boaters in areas of poor compliance that had high numbers of watercraft-related manatee deaths. Service officers issued tickets to 670 violators during these operations. During 2002 the Coast Guard also cited 711 violators for exceeding posted speed limits in various parts of Florida.

Although boat speed zones likely have helped limit the number of watercraft-related manatee deaths to some unknown extent, their effect has not been evident in overall watercraft-related mortality trends, which have continued to increase. This may be due to a number of factors. In part, the continuing increase may reflect increasing numbers of manatees. However, the 10 percent rate of increase in watercraft-related deaths in recent years exceeds what could reasonably be expected to be the potential maximum rate of manatee population growth. It is unclear how fast manatee abundance may have grown in recent years, but for some areas, recent declines in adult survival rates suggest that population growth rates may have slowed and even declined in recent years.

Increasing numbers of boats also may be responsible for the increase in watercraft deaths. Data from the Florida Division of Law Enforcement reported that 829,000 state-registered vessels and about 300,000 out-of-state boats used Florida waterways in 1999. Two years later in 2001, those combined figures had risen nearly 20 percent to 943,600 state-registered vessels and 400,000 out-of-state boats. Given this rate of increase, it is possible that boat speed zones have helped stem the increase in watercraft-related deaths but not enough to prevent the problem from becoming worse. The recent increase in the number of boats has risen faster than it did in the 1980s and early 1990s but could slow with the recent economic downturn of the past few years. It seems highly unlikely, however, that the number of boats will decrease in the foreseeable future, given Florida's steadily increasing human population.

Low rates of boater compliance in established zones also may be a factor. Studies undertaken by the Florida Marine Research Institute have revealed low levels of compliance by boaters in some areas, with operators of relatively small outboards and personal watercraft responsible for most violations of posted speed limits. Obviously, if zones are established and posted but not widely obeyed, they will not be effective. It also is possible that speed limits established for some areas have not provided a level or form of protection commensurate with manatee protection needs. For example, in some areas where high-speed traffic has been allowed adjacent to shoreline or nonchannel speed zones in deference to boating interests, watercraft-related manatee deaths have remained high.

It also is possible that manatees may have limited abilities to evade even slow-moving boats. Although this is possible, it does not appear to have been a factor in recent trends. If this were the case, one would expect an increase in the proportion of animals killed by propeller wounds and a decrease in the proportion killed by blunt trauma impacts because boats in key manatee habitats spend more time traveling slowly in response to new speed zones. However, there has been no obvious change in these proportions since work began to expand the network of boat speed zones in the early 1990s. Of 406 watercraft-related manatee deaths between 1979 and 1991, 39 percent were caused by propeller wounds, 55 percent by blunt impact, and 6 percent by a combination of both or unspecified causes. Of the 585 watercraft-related deaths from 1992 through 2001, 33 percent were caused by propellers, 57 percent by impact, and 10 percent by a combination of both. Thus, there does not appear to have been an increase in deaths that might arguably be linked to boats traveling at slow speeds.

To resolve questions about factors that influence the effectiveness of boat speed regulatory zones, it may be necessary to treat some speed zones as index sites where detailed monitoring and perhaps some management manipulation (e.g., various documented levels of enforcement, signage, and public education) would be undertaken. Assessing the effectiveness of different types of zones seems particularly important. The latter probably would require comparing data on watercraft-related manatee deaths in a particular area during periods of different regulatory regimes. Areas in which past

watercraft-related deaths have been relatively frequent (e.g., the Barge Canal and Sykes Creek in Brevard County) may provide the best opportunities in this regard. In the near term, further enforcement, public education, and attention to the adequacy of zones in high-mortality areas seem warranted.

**Proposed Incidental Take Rules**—The Marine Mammal Protection Act prohibits both the intentional and unintentional taking of marine mammals unless authorized under certain limited exceptions. Under the Act, taking includes harassing, injuring, or killing. One of the Act's exceptions to this provision is section 101(a)(5), which authorizes the Fish and Wildlife Service, upon request, to develop regulations that would allow specific activities to incidentally, but unintentionally, take small numbers of marine mammals. In issuing such regulations, the Service must find, in part, that the total take by the requested activity over the period that the regulations are in effect (i.e., a maximum of five years) would have no more than a negligible impact on the affected species or stock.

In partial response to a settlement agreement for a lawsuit filed by several environmental groups against the Fish and Wildlife Service and the Army Corps of Engineers, the Service published proposed regulations on 14 November 2002 under section 101(a)(5) to help implement measures to limit watercraft-related manatee deaths. The proposed regulations identified procedures that the Service would use to issue letters of authorization to certain government agencies whose programs authorize the operation of watercraft or the construction of watercraft access facilities in three areas of Florida. Specifically, the letters would authorize the incidental but unintentional take of manatees under the Army Corps of Engineers' section 404 Clean Water Act permitting program. Under that program, the Corps issues dredge and fill permits required for the construction of marinas, docks, and certain other watercraft access facilities. The process for issuing letters of authorization also would be available to other state and federal agencies should they choose to request a letter of authorization for their government programs concerning watercraft operations or watercraft facilities that could affect manatees.

Procedurally, the proposed regulations provided that, upon receiving a request from a government agency for incidental take authorization,



Figure 35. Florida manatees occur in at least four discrete stocks: northwestern and southwestern Florida, the Atlantic coast, and the upper St. Johns River. (Figure by Sirenia Project, courtesy of the U.S. Geological Survey.)

the Service would review the agency's described program to determine if it would cause watercraft-related deaths to exceed negligible levels. For depleted species, such as the Florida manatee, generally accepted guidance defines negligible levels of taking as those that (1) do not exceed 10 percent of a population's net productivity, and (2) do not delay the projected time required for the population to reach its optimum sustainable population level by more than 10 percent. The Service indicated its intention to use the latter standard to determine negligible levels of take for manatees. To make this determination, the Service also noted that it planned to use a population model that was still under development.

If it is determined that the agency's program could cause levels of taking that exceed negligible levels, the Service would then identify additional measures to prevent such an occurrence. If it could not make a finding that take levels could be maintained at negligible levels, it could not issue a letter of authorization. For purposes of limiting tak-

ing by watercraft, the Service advised that it would rely on the following general types of measures: (1) rules to restrict boat speed and waterway access, (2) enforcement of those rules, (3) boater education and awareness programs, (4) measures in county manatee protection plans and government permit programs to guide the location and development of new watercraft access facilities, and (5) technological measures, such as propeller guards. If specific measures were deemed necessary to prevent taking in excess of negligible levels, the Service would include those in its letter of authorization to the requesting agency.

As indicated above, to issue such regulations the Service must find that the levels at which manatees are taken by watercraft will not exceed negligible levels. Florida manatees have been divided into four separate stocks (Fig. 35). For two of these regional subpopulations, the upper St. Johns region and northwestern Florida, the Service concluded that watercraft-related deaths currently are at negligible levels and that no additional mitigation mea-

asures would be needed to implement the Corps' permit program. For one region, the Atlantic coast region, it concluded that current mortality levels exceed negligible levels but that additional mitigation measures plus existing measures would reduce impacts to negligible levels. For the fourth region, southwestern Florida, the Service concluded that information was not adequate to make a determination at this time. To reach these conclusions, the Service considered information on watercraft-related deaths and compared the status of the four manatee subpopulations with population benchmarks developed to provide measurable criteria for downlisting and delisting manatees under the Endangered Species Act.

At the end of 2002 the Commission was developing comments and recommendations on the Service's proposed rule.

The Service's proposal reflects a novel, albeit perhaps ill-suited, use of section 101(a)(5) authority. This section of the Act was developed to provide a mechanism for authorizing insignificant levels of take by individuals or industry groups engaged in specific activities for a set period of time, rather than for government programs making decisions on thousands of individual projects on an ongoing basis.

In attempting to use this section to address watercraft impacts, the Service's proposal raises a number of significant substantive and procedural issues. First, the Service's conclusions that current levels of watercraft-related manatee deaths are currently below or near negligible levels for three of the four Florida regions are questionable and lack supporting calculations to show that its chosen negligible impact standard (i.e., not delaying recovery time to optimum sustainable levels by more than 10 percent) would be met. Under the other generally accepted standard not considered by the Service (i.e., not exceeding 10 percent of a population's net productivity), the net productivity level for the total Florida manatee population would have had to have been at least 980 for the 98 watercraft-related deaths in 2002 to be considered negligible; and even that level would include no consideration for serious injuries and other forms of nonlethal taking. Such a high net productivity is unrealistic for a population that may number little more than 3,276 and whose females, at best, successfully rear a single calf every two years.

Also, the Service asked for comments on a proposal to use a population model not yet completed to assess negligible impact levels. There was, however, no way to test the model's utility for this purpose. As required by the provisions of section 101(a)(5), the proposal also did not set forth the specific research, monitoring, or mitigation measures that would be needed to assure that impacts do not exceed negligible levels. Instead, the regulations deferred decisions on those measures to a point when opportunity for public review and comment on a requested authorization would not be provided.

Given these points, it appeared that a more appropriate approach for identifying and implementing needed measures to reduce watercraft-related mortality would be through developing county manatee protection plans that meet established standards and criteria of acceptability. The Commission had previously recommended such an approach following its review of the manatee program in 2000. In 1989 such plans had been mandated for some counties as part of the Florida Growth Management Act, but only a few counties prepared them. In view of the controversy surrounding the issuance of permits for watercraft access facilities and the establishment of boat speed regulatory measures, it also appeared highly desirable that a long-term issue resolution process be established to bring all concerned parties together to help develop an optimal strategy for identifying and implementing additional manatee protection measures as may be needed. At the end of 2002 the Commission was in the process of summarizing these and other comments in a letter to be sent to the Service early in 2003.

## **Manatee Sanctuaries and Refuges**

Regulations adopted by the Fish and Wildlife Service in 1979 authorize the agency to designate manatee sanctuaries and manatee refuges for the purpose of manatee protection. Manatee sanctuaries are areas in which all human activities are precluded, and manatee refuges are areas where specified human activities may be regulated. Before 2001 these regulations had been used to establish only seven small manatee sanctuaries (about 50 acres combined) in Kings Bay, a warm-water refuge at the head of the Crystal River on Florida's west coast.

Pursuant to negotiations to settle a lawsuit filed in January 2000 by several environmental groups against the Service and the Army Corps of Engineers alleging violations of federal statutes protecting manatees, the Service agreed to pursue actions to designate additional manatee sanctuaries and refuges. The Service subsequently requested comments and advice on potential new sites and, as noted in previous annual reports, the Commission suggested several possible areas. Based on submitted comments and its own analyses, the Service published a proposed rule on 10 August 2001 to designate 12 new manatee refuges and 4 new sanctuaries.

**Designation of the Barge Canal and Sykes Creek Manatee Refuges**—On 7 January 2002 the Service published a final rule to designate two of the 16 areas it had proposed as new manatee sanctuaries and refuges. The two areas, located within about a mile of each other on Merritt Island near Cape Canaveral, were designated as manatee refuges for the purpose of strengthening boat speed restrictions. One was located in a portion of Sykes Creek (846 acres) and the other was in a dredged cut called the Barge Canal (683 acres). The Service decided to defer action on the other 14 sites in lieu of steps the State of Florida planned to take to consider additional protection needs for those and other areas under state authority.

The two designated areas are heavily used by manatees as a travel corridor. Sixteen watercraft-related manatee deaths have been recorded in the area as of 2000, making it among the most deadly areas in Florida for manatees. The Barge Canal, about seven miles long and 150 feet wide, is heavily used by recreational boaters transiting between the Intercoastal Waterway, Sykes Creek, and the Banana River. Under state rules, much of the Barge Canal had been regulated as a channel-exempt speed zone, with a 25 mph limit in the channel and a slow speed limit along the banks, with four slow-speed segments along portions of the channel. High-speed boat traffic also has been allowed in Sykes Creek, which connects to the Barge Canal. Because of continuing manatee mortalities in both areas, the state had previously proposed to make both areas a slow-speed zone, but due to rule-making appeals filed to block the action, it was unclear whether or when the rule would go into effect. The Service therefore decided to proceed with designating the two areas as manatee refuges and to re-

quire year-round slow speeds in case the state was unable to implement its rule.

**Proposed Exemption Process**—On 16 April 2002 the Service proposed amending its new regulations for the Barge Canal to establish a process for authorizing exemptions to the slow-speed restrictions. The proposed rule was prompted by a request from a boat manufacturer with facilities along the canal who wanted to be able to continue testing new boat designs at high speeds in the canal. The Service also proposed issuing an exemption to the company if it was determined that no manatees would be taken during testing operations. The rule noted that the Service had concluded that it may be possible to conduct the activity without placing manatees at risk by using observers or technological methods to ensure that no manatees are present in the area when the boats are tested.

The Commission commented on the proposed rule on 28 June 2002, noting that available records indicate that at least two manatees had been struck and killed in the Barge Canal by the company's boats and that granting the exemption would set an ill-advised precedent. Among other things, it noted that high-speed travel areas existed within two miles of the company's facilities, a 15-minute trip each way at slow speeds. It also noted that an exemption to operate vessels at high speed in a confined, heavily traveled corridor where other boats were limited to slow speed could pose a navigation hazard. In addition, the exemptions could complicate efforts to assess the effectiveness of the new slow-speed rules. By carefully monitoring watercraft compliance and documenting enforcement efforts, the new refuges could provide an important opportunity for assessing the potential effectiveness of both boat speed restrictions and enforcement efforts.

The Commission also questioned the Service's conclusion that it may be possible for observers and technological detection methods to assure that no manatees are present in the area during times of testing. It noted that visual detection of manatees would be limited due to poor water clarity in the Barge Canal, and that detection technologies, such as acoustic detection or sonar, had not been proven reliable. As a general matter, the Commission therefore recommended that any applicant asserting that it would be possible to assure that manatees are not present in a given area at a given time be required to demonstrate that ability.

The Commission also noted that, although the proposed exemption process allowed for public review of submitted applications, it did not provide a similar opportunity to review the Service's views on the request or any terms and conditions that it planned to require. The Commission therefore recommended that the exemption process be revised to provide public notice and opportunity to comment on the Service's intent to approve, deny, or condition a requested exemption and the rationale for its proposed action.

As of the end of 2002 the Service had taken no further action on its proposed amendment rule, and it was unclear if it planned to grant the requested exemption to test boats at high speed in the Barge Canal.

**Other Manatee Sanctuaries and Refuges**—In the spring of 2002 the Florida Fish and Wildlife Conservation Commission initiated a rulemaking process to consider possible measures to protect certain manatee habitats, including areas that the Service had proposed to designate as manatee sanctuaries and refuges. In July 2002, however, the District Court for the District of Columbia found that the Service's decision to defer action on its proposed sanctuaries and refuges violated the terms of a 7 November 2001 settlement agreement reached between the Service and environmental groups on the abovenoted lawsuit.

On 20 September 2002 the Service therefore published emergency rules to designate four of the

sanctuaries and three of the refuges that it had previously deferred (Table 9). All seven areas were associated with warm-water refuges on Florida's west coast. With the approach of winter, the Service's notice advised that it had determined that manatees in those areas were at risk of imminent danger without the action. The four sanctuaries, which prohibit all waterborne activity from 1 October through 31 March, included the Blue Waters Manatee Sanctuary (4.1 acres) adjacent to the Homosassa Springs State Wildlife Park, and warm-water outfalls at three power plants in Tampa Bay — the Bartow Electric Generating Plant (181.5 acres), and the Tampa Electric Company's Big Bend plant (76.2 acres) and Gannon plant (2.7 acres). The three refuges included waters immediately adjacent to the three sanctuaries in Tampa Bay and established slow and idle speed zones also effective from 1 October through 31 March.

The emergency rules were to be effective from 1 October 2002 through 20 January 2003. On 8 November 2002 the Service published final rules making all but one of the seven sanctuaries and refuges permanent. Because of a more protective county ordinance at the manatee refuge associated with the Gannon power plant, the Service withdrew that refuge. The final rules also changed the effective period for the other six refuges to 15 November to 31 March and modified most of the area boundaries to make them conform with state and local measures.

**Table 9. Manatee sanctuaries and manatee refuges designated in Florida by the Fish and Wildlife Service in 2002**

Site	Status	County	Regulation	Proposed Acreage	Final Acreage
Blue Waters	Sanctuary	Citrus	No Entry	4.1	1.6
Bartow Power Plant	Sanctuary	Pinella	No Entry	181.5	29.8
Big Bend Power Plant	Sanctuary	Hillsborough	No Entry	76.2	29.9
Port Sutton Power Plant	Sanctuary	Hillsborough	No Entry	2.7	2.7
Bartow Nav. Channel	Refuge	Pinella	Withdrawn	74.8	—
Big Bend	Refuge	Hillsborough	Idle Speed	230.9	220.8
Port Sutton	Refuge	Hillsborough	Idle Speed	96.9	96.9
Pansy Bayou	Refuge	Sarasota	Slow Speed	116.1	116.1
Little Sarasota Bay	Refuge	Charlotte	Slow/25 Channel	529.4	529.4
Lemon Bay	Refuge	Charlotte	Slow/25 Channel	948.0	948.0
Piece River	Refuge	Charlotte/DeSoto	Various	12,088.1	4,196.1
Shell Island	Refuge	Lee	Slow Speed	80.5	80.5
Haulover Canal	Refuge	Brevard	Slow Speed	682.7	22.1
Cocoa Beach	Refuge	Brevard	Slow Speed	59.1	59.1
Barge Canal	Refuge	Brevard	Slow Speed	682.7	682.7
Sykes Creek	Refuge	Brevard	Slow Speed	845.8	845.8

The Service's 8 November 2002 final rules also designated seven other manatee refuges (Table 9) with year-round requirements for using slow speed, channel-exempt slow speed, and/or shoreline slow speed. Several of the designated areas were smaller than those initially put forth in the Service's 10 August 2001 proposed rules.

Thus, including the Barge Canal and Sykes Creek established in January 2002, the Service designated four new manatee sanctuaries (totaling 64 acres) and 11 new manatee refuges (totaling 7,269 acres) during 2002.

**State Regulatory Areas**—As part of a settlement agreement on a lawsuit concerning manatee protection filed by several environmental groups against the Florida Fish and Wildlife Conservation Commission, the latter considered rulemaking action during the spring of 2002 to establish new boat speed zones in 16 areas around the state. Most of those areas included waters that had been proposed for designation as manatee refuges and sanctuaries in the 10 August 2001 *Federal Register* notice published by the Fish and Wildlife Service. The Florida conservation commission subsequently held public hearings in the summer of 2002, and in the fall of 2002 it adopted rules to proceed with 10 of the 16 sites under consideration. As of the end of 2002 one site had been posted and work was under way or being planned to post the remaining nine sites.

**Assessing Boater Compliance**—To assess compliance with established zones, the Florida Marine Research Institute, the Fish and Wildlife Service, Mote Marine Laboratory, and others have supported studies at various speed zones around the state. The studies involve placing observers along regulated waterways to monitor and record data on boat traffic and vessel speed. Such studies are labor-intensive and expensive.

To explore the development of a less expensive, more efficient way to monitor compliance, the Commission and the Fish and Wildlife Service provided funding to the Florida Marine Research Institute in 2001 to contract for the development of a remotely operated photographic system to monitor vessel traffic and vessel speeds on waterways used by manatees. The intent was to develop an easily portable system that could record and transmit photos of vessels and data on vessel speed over a wireless Internet connection to a remote site and thereby speed the process of gathering compli-

ance data. In 2002 the contractor developed such a device but, because of difficulty in obtaining a laser range-finding device, data collection capabilities were somewhat limited compared with the initially envisioned system. As of the end of 2002 the Commission and the Institute were working with the contractor to identify options to overcome the technical difficulties. It is hoped that, with further efforts, the device can be perfected in 2003.

## Management Strategies for Warm-Water Refuges

Almost all manatees in Florida depend on natural or artificial warm-water refuges to survive winter cold periods (Fig. 36). About 60 percent of the manatees seen during the maximum count of 3,276 animals in January 2001 occurred at power plant outfalls. Because of threats to manatees at both natural warm-water springs and power plant outfalls, the third revised Florida manatee recovery plan assigns its highest priority ranking to tasks necessary to implement a long-term strategy for ensuring a safe, dependable network of warm-water refuges. In 1999 the Service convened a workshop to identify research and management actions needed to develop such a strategy. Shortly after that workshop, a warm-water task force composed of agency and industry representatives was established to help plan and oversee related work.

Figure 36. Natural and artificial warm-water refuges with at least one count of 40 or more Florida manatees (power plants are identified in roman and natural springs in italics). (Figure by Leslie Ward, courtesy of the Florida Marine Research Institute.)

In 2002 to support a warm-water task force adaptive management planning initiative, the Fish and Wildlife Service provided funds to the U.S. Geological Survey and the Florida Fish and Wildlife Conservation Commission to develop a manatee response model and related research. With those funds, researchers increased efforts to survey and photo-identify manatees at East Coast power plants to assess manatee responses to various temperature and climate changes. Task force members also worked to standardize the collection of temperature data at the various plants. Preliminary modeling efforts are scheduled to begin early in 2003.

Because of the possibility that power plants now used by manatees could be retired and closed, the Commission has recommended that consideration be given to constructing nonindustry-dependent warm-water refuges within the current winter range of manatees. Such refuges might minimize the discharge of heated water into waterways to minimize thermal pollution while replacing existing industry-dependent warm-water refuges. As discussed in the previous annual report, the Florida Power & Light Company contracted for studies to (1) consider possible sites for such refuges along the east coast of Florida where it operates several power plants used by manatees and (2) assess the engineering feasibility, land requirements, and construction costs associated with a solar-powered water-heating system that could support manatees through the winter at a site on the east coast.

Results of the former study were completed in 2001 and are reported in the previous annual report. It identified four possible sites based on factors such as proximity to sea grass feeding areas and local boat traffic patterns. The second study, completed in 2002, concluded that existing solar heating technology could provide a requisite amount of warm water to maintain a small embayment at temperatures that would sustain manatees through the winter. To maintain a 100 by 150-ft. embayment six feet deep at a temperature of 68°F, construction costs for an adequate field of solar energy collectors were estimated at approximately \$135,000. This cost would increase to about \$750,000 to maintain a temperature of 80°F. It was estimated that one-half acre would be required for the solar field. Additional costs would be required for maintenance, pumping, and possibly land acquisition (many of the potential

sites identified in the initial study were adjacent to publicly owned lands and thus many require no land acquisition).

During 2001 and 2002 Florida Power & Light Company also undertook work to repower its Fort Myers power plant on the west coast of Florida. The plant outfall has been used by more than 300 manatees on several occasions during cold periods in recent winters, and on one occasion was reported to have more than 400 animals. To proceed with repowering work in January 2002, the company had to temporarily shut down the warm-water discharge from the plant's generating units. For the sole purpose of ensuring an adequate warm-water refuge for manatees that have come to depend on the plant's effluent, the company temporarily installed an auxiliary oil-fired water heating unit called a "donkey boiler" for the winter period of reduced plant discharges. Although the heated area was smaller than that produced by the operating plant, manatees continued using the outfall under the temporary arrangement. Work to repower the plant and resume the warm-water discharge was completed before the onset of winter at the end of 2002.

### **Entrapment in Flood Gates**

The second largest source of human-related manatee mortality has been the crushing or drowning of animals that become pinned in closing flood gates and navigation locks. Most of these water control structures are owned or operated by either the South Florida Water Management District or the U.S. Army Corps of Engineers. In 1994 manatee deaths in such structures reached a record high of 16 animals. To prevent such deaths, the two agencies, at the urging of the Florida Bureau of Protected Species Management and the Fish and Wildlife Service, initiated engineering studies to develop mechanisms to be installed on gate and lock doors that, like elevator doors, would automatically stop and reverse closing operations when a manatee became caught in them.

After considerable effort and design work, promising devices were developed in the mid-1990s for both flood gates and navigation locks. The Corps and the District developed a list of more than 20 structures to be retrofitted with the new devices and secured funding to begin installation work. The first flood gate was equipped in 1997 and the first navigation lock was retrofitted in 1998.

Since then the agencies have been installing the devices as time and funding permit. Initial work has focused on those structures that had the highest manatee mortality. Manatee deaths at gates and locks equipped with new devices have dropped to very low levels. When deaths have occurred, adjustments have been made to further reduce the entrapment risks. As of the end of 2002, 12 structures had some type of protection devices in place and work was under way at another flood gate. During 2002, five manatees were killed at water control structures, but none of them occurred at structures that have been retrofitted with the new devices.

### **Petition to the State of Florida to Reclassify Manatees**

Florida manatees are listed as endangered under both the U.S. Endangered Species Act and state law. In light of the January 2001 count of 3,276 manatees, the Coastal Conservation Association of Florida petitioned the Florida Fish and Wildlife Conservation Commission to reevaluate the status of Florida manatees under state law. The Association believed that, under state law, manatees could be delisted or downlisted to a status of “threatened” or “species of special concern.” In response to the petition, the Florida conservation commission requested comments on the status of Florida manatees relative to the state’s definitions for the various protected species categories.

The terms “endangered,” “threatened,” and “species of special concern” are defined in Chapter 68 of the Florida Administrative Code and were adopted in 1999 based on definitions used by the World Conservation Union to define “critically endangered,” “endangered,” and “vulnerable” species. The World Conservation Union’s definitions were developed to identify species most urgently in need of protection on a worldwide basis and apply to any species of plant or animal. The definitions are complex and stringent and are ill-suited to species such as marine mammals that are long-lived, wide-ranging, slow-reproducing, and slow to recover. For example, definition of a critically endangered species includes such criteria as having a population size of less than 50 individuals, a population size of fewer than 250 individuals that also is declining at a rate of 25 percent per generation,

a distribution of less than 40 square miles, and a projected decrease in population size of at least 80 percent within the next 10 years.

In the early 1990s the World Conservation Union proposed that these definitions be used as listing criteria for species protected under the Convention on International Trade in Endangered Species of Fauna and Flora. At that time, the Commission wrote to the Fish and Wildlife Service, which represents the United States at Convention meetings, commenting that several highly endangered marine mammals would not meet the listing criteria and that the criteria were flawed, at least as they applied to marine mammals.

On 9 August 2002 the Marine Mammal Commission responded to the Florida conservation commission’s request for comments on the petition. In its letter the Marine Mammal Commission reiterated its concerns about the World Conservation Union’s criteria and enclosed a copy of its 1993 letter to the Service. It noted that the Florida manatee did not appear to qualify under any criteria adopted by the state to define “endangered” or “threatened species,” or “species of special concern.” It also noted, however, that the definitions of those terms were entirely inappropriate for assigning marine mammals and certain other species, such as sea turtles, to those categories. It noted, for example, that under the state’s definitions, North Atlantic right whales, which number about 300 animals—and are rarer than giant pandas and most tigers — also would not qualify as either endangered or threatened. As a general matter, the Commission noted that the criteria did not adequately address species that are long-lived, wide-ranging, slow to reproduce, and slowly recovering from depletion.

The Marine Mammal Commission, therefore, recommended that the Florida conservation commission revise its definitions and criteria for the three protected species categories to take into account life history characteristics that typify marine mammals. Pending such revisions, it recommended that Florida manatees remain listed as endangered species under state law.

As of the end of 2002 the Florida conservation commission was scheduled to consider the petitioned action at its first meeting in 2003.